

below the superior and inferior extents of the target volume. For patients that received planning CT scans both immediately before and after rectal tube insertion, treatment plans were generated retrospectively with matched rectal D2cc. The resulting plans were compared visually, and the dose received by the HR-CTV D90 was compared.

**Results:** All patients were treated with a combination of external beam radiotherapy to the pelvis and 3-5 fractions of high-dose rate interstitial brachytherapy in twice daily fractions. Ten and 19 patients were treated without and with a rectal tube respectively. Rectal volume between the first and third fractions was significantly more reproducible in the rectal tube group ( $p = 0.038$ ). There was a significant increase in the HRCTV D90 with the use of a rectal tube (mean HRCTV D90 99.5% in the non-rectal tube group and 106% in the rectal tube group,  $p = 0.002$ ). There was no significant difference in the D2cc rectum between the two groups ( $p = 0.77$ ). Seven patients received a planning CT immediately prior to and immediately after rectal tube insertion, and plans with matched rectal doses were generated (11 pairs of plans). For these patients there was no significant difference in the HRCTV D90 between the rectal tube and no rectal tube plans ( $p = 0.187$ ). There were seven plans in which the use of a rectal tube increased the HRCTV D90, and four plans in which it lowered the HRCTV D90. On visual inspection of these plans the rectal tube appeared to push the rectal wall anteriorly.

**Conclusions:** For the patients included in this study, the use of a rectal tube in ISBT significantly reduced variability in rectal volume between the first and third treatment fractions. Overall the use of a rectal tube was associated with a significantly increased dose to the HRCTV D90, and no significant change in the D2cc to the rectum. However, for some patients the use of a rectal tube may worsen dosimetric parameters if the rectum is pushed anteriorly towards the target volume by the relatively stiff rectal tube. Further work is required in identifying patients who may not benefit from use of a rectal tube.

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#### CERVICAL CANCER BRACHYTHERAPY IN CANADA: A FOCUS ON INTERSTITIAL BRACHYTHERAPY UTILIZATION

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**Purpose:** Brachytherapy (BT) techniques for cervical cancer (CC) in Canada have changed over the last decade, with evolution to HDR and image-guided BT. However, there are currently no national data on the use of interstitial BT (IBT) in the management of patients with CC. The purpose of this study was to document IBT utilization in Canadian centres, as well as update details of CC BT practices.

**Methods and Materials:** All Canadian centres with gynecologic BT services ( $n = 32$ ) were identified, and one gynecology radiation oncologist per centre was sent a 33-item e-mail questionnaire regarding the centre's practice for CC BT in 2015. Responses are reported and compared with practice patterns identified in a 2012 Canadian survey.

**Results:** The response rate was 81% (26 of 32 centres). The majority (92%) used high-dose rate (HDR) BT, identical to the 2012 survey. Ninety-three percent (24 of 26) of centres had transitioned to 3D MRI/CT based planning by 2015, versus 80% in 2012. Sixty-five percent of centres incorporated MRI for treatment planning in 2015 compared to 37% in 2012; the majority (13/16) using a combination of MRI and CT. Fifty percent (13 of 26 centres) had the capacity to perform IBT; in those that did not, 50% referred patients to other centres who performed the procedure. Of centres performing IBT, the majority (nine out of 13) used free-hand template-based techniques. For IBT, a median of five (range 2-20) needles/catheters was used and an average of four (range 1-5) fractions were delivered. Catheters were placed using a variety of image-guidance modalities: pre-op imaging (54%), intra-op MRI (8%), intra-op CT (23%), and intra-op U/S (46%). The majority

(77%) of centres performing IBT used inverse planning techniques. The most common dose/fractionation schedules were 6 Gy x 5 fractions (40%), 8 Gy x 3 fractions (19%) and 7 Gy x 4 fractions (15%).

**Conclusions:** In Canada, treatment of cervical cancer continues to evolve. Interstitial BT has been adopted by half of the responding centres. As more centres move to MRI-based image-guided treatment planning, IBT will become an even more integral part of cervical cancer treatment.

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#### EXTERNAL VALIDATION OF THE PROCARS NOMOGRAMS FOR LOCALIZED PROSTATE CANCER

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**Purpose:** Risk stratification for localized prostate cancer can assist clinicians select the most appropriate treatment for their patients based on baseline clinical factors. The present study aimed to externally validate a recently published nomogram for low-dose rate (LDR) brachytherapy that was developed in patients treated in several Canadian centers.

**Methods and Materials:** Patients receiving LDR brachytherapy at the Centre Hospitalier de l'Université de Montréal (CHUM) for localized prostate cancer between 2005 and 2015 and with a minimum of six months of follow up were eligible for analysis ( $n = 903$ ). External validation was performed on the ProCaRS nomogram for LDR-brachytherapy to predict five-year biochemical failure free survival (BFFS). This was performed using calibration plots of nomogram predicted probability compared to corresponding Kaplan-Meier five-year BFFS estimates.

**Results:** Mean age of the validation cohort was 65 years and median baseline PSA was 5.5 ng/mL. All patients had T1 (75%) or T2 (25%) disease and most had either Gleason 6 (70%) or Gleason 7 (29%). Mean D90 was 161 Gy (standard deviation [SD] 25) and 10% of patients received D90 < 130 Gy. Reasonable nomogram calibration was observed ( $R^2 = 0.778$ ), however this produced an underestimation of the true survival for all values based on the point estimates, particularly for nomogram predicted survival < 90% and 92-94%. This finding may be partially attributed to the limited number of patients with observed BFFS < 90% and a shorter follow up in the CHUM compared to the original cohort used to develop the nomogram. A sensitivity analysis was performed to determine an adjustment to the nomogram predicted probability to improve calibration. Applying an adjustment of +3.24% to the nomogram predicted probability yielded a more favourable calibration for both nomograms (adjusted  $R^2 = 0.813$ ).

**Conclusions:** We believe the LDR brachytherapy ProCaRS nomogram is a clinically useful tool that may help clinicians in treatment selection and outcome prediction for prostate cancer. For instance, it may be useful in counseling patients with intermediate-risk cancers that may benefit from exclusive LDR brachytherapy.

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#### TREATMENT OF UNRESECTED LOCALLY ADVANCED BREAST CANCER WITH HYPOFRACTIONATED PARTIAL BREAST IRRADIATION: CLINICAL OUTCOMES AND FEASIBILITY

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